



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/749,668	12/30/2003	Theodore S. Moise IV	TI-36398	9759
23494	7590	07/13/2007		
TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265			EXAMINER KALAM, ABUL	
			ART UNIT 2814	PAPER NUMBER
			NOTIFICATION DATE 07/13/2007	DELIVERY MODE ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@ti.com  
uspto@dlemail.itg.ti.com

<b>Office Action Summary</b>	<b>Application No.</b> 10/749,668	<b>Applicant(s)</b> MOISE ET AL.	
	<b>Examiner</b> Abul Kalam	<b>Art Unit</b> 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 April 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 March 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)     | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date. _____  | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. **Claims 1-6 and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Uchiyama et al. (US 6,831,313)** in view of **Fox et al. (6,627,930)**.

With respect to **claim 1**, **Uchiyama** teaches an integrated circuit comprising:

An array of ferroelectric memory cells (**445; col. 11, lines 38-43**), each cell (**100; FIG. 5**) having a capacitor stack (**128**) having a single ferroelectric core layer (**124; col. 9: Ins. 49-62**), wherein at least one of the capacitor stacks (**128**) comprises a conductive contacts (**122**) formed under the single ferroelectric core (**124**), wherein the conductive contact (**122**) has a cross section near a contact portion with the bottom portion of the stack, that is about as large or larger than that of the ferroelectric cores (**FIG. 5**).

Thus, **Uchiyama** teaches all the limitations of the claim with the exception of disclosing: wherein the single ferroelectric core layer has a crystallization in the (001) family and at least 40% of the domains of the single ferroelectric core layer are functionally oriented with respect to the capacitor stack.

However, **Fox** teaches a capacitor stack (**10<sub>2</sub>; FIG. 1B**) having a single ferroelectric core layer (**18**) with a crystallization in the (001) family (**FIG. 1B; col. 4: Ins.**

**1-21**), wherein at least about 40% of the domains are functionally oriented with respect to the capacitor stack.

Regarding the claimed "at least about 40% of the domains are functionally oriented with respect to the capacitor stack," **Fox** discloses that the entire single ferroelectric core layer (**18; FIG. 1B**) has a crystallographic texture of  $\langle 001 \rangle$ , and thus it is implicit that about 50-100% of the domains are functionally oriented with respect to the capacitor stack (**col. 4: Ins. 9-11, 17-19**).

Furthermore, note that the specification contains no disclosure of either the *critical nature of the claimed*, "at least 40% of the domains are functionally oriented with respect to the capacitor stack," or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the device of **Uchiyama** with the teaching of **Fox**, to form the single ferroelectric core layer having a crystallographic texture of  $\langle 001 \rangle$ , because such crystallization structures are generally preferred due to the orientation of polarization (**col. 4: Ins. 17-21**).

With respect to **claim 2**, **Uchiyama** and **Fox** teach all the limitations of the claim, as set forth above in claim 1, with the exception of disclosing: wherein about 45

to about 75% of the domains are functionally oriented with respect to the capacitor stack.

However, it would have obvious to one of ordinary skill in the art to form a ferroelectric layer with about 45 to about 75% of the domains functionally oriented, as claimed, because absent evidence of disclosure of criticality for the range or dimensions giving unexpected results, it is not inventive to discover optimal or workable ranges or dimensions by routine experimentation. See *In re Aller*, 220 F.2d 454, 105 USPQ 233, 234 (CCPA 1955).

With respect to **claim 3, Uchiyama and Fox** teach the integrated circuit of claim 1 above. Furthermore, **Fox** teaches wherein the ferroelectric cores are PZT cores (**col. 6, lines 9-37**). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the device of **Uchiyama** with the teaching of **Fox**, for the reasons set forth above in claim 1.

Regarding the limitation, "the PZT of each core has a switched polarization of at least about  $60 \mu\text{C}/\text{cm}^2$ ," the specification contains no disclosure of either the *critical nature of the claimed*, "switched polarization of at least about  $60 \mu\text{C}/\text{cm}^2$ ," or any unexpected results arising therefrom. Where patentability is said to base upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With respect to **claim 4, Uchiyama and Fox** teach the integrated circuit of claim 1 above. Furthermore, **Uchiyama** teaches a dielectric layer (**142; FIG. 5**) covering the

array (445; col. 11, lines 38-43) of memory cells (100), the dielectric layer having a conductive contact (139) over each ferroelectric core (124), the conductive contact having a cross section about as large or larger than that of the ferroelectric cores (124, FIG. 5) (col. 10, Ins. 9-19; col. 11).

With respect to claim 5, Uchiyama and Fox teach the integrated circuit of claim 1 above. Furthermore, Uchiyama teaches electrodes (122, 126) adjacent opposing sides of the ferroelectric cores (124) (col. 9, Ins. 49-62).

Regarding the limitation, "electrodes adjacent opposing sides of the ferroelectric cores have a collective thickness of at least about 200 nm thick," the specification contains no disclosure of either the *critical nature of the claimed*, "collective thickness of at least about 200 nm," or any unexpected results arising therefrom. Where patentability is said to base upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With respect to claim 6, Fox and Uchiyama teach the integrated circuit of claim 1 above. Furthermore, Uchiyama teaches wherein each of the capacitor stacks (128) are formed over conductive contacts (120), the conductive contacts having a cross section near their top that is about as large or larger than that of the ferroelectric cores (124) (FIG. 5).

With respect to claim 21, Uchiyama and Fox teach the integrated circuit of claim 1 above. Furthermore, Uchiyama teaches a dielectric layer (136; FIG. 5)

covering the array (445; col. 11, lines 38-43) of memory cells (100), the dielectric layer having a conductive contact (126) over each ferroelectric core (124), the conductive contact having a cross section about as large or larger than that of the ferroelectric cores (124, FIG. 5) and extending through said dielectric layer (136) to a metal interconnect layer (139) (col. 10, Ins. 9-19; col. 11).

### ***Response to Arguments***

2. Applicant's arguments with respect to claims 1-6 and 21, as presented in the remarks filed on April 30, 2007, have been fully considered but are not persuasive.

Applicant argues that a given texture does not imply that 100% of the domains are functionally oriented with respect to the capacitor stack. This is not persuasive because FOX clearly shows in Fig. 1B that a <001> crystallographic texture has all of its domains functionally oriented with respect to the capacitor structure. In other words, a <001> crystallographic texture will have its polarization vector parallel to the vertical direction of the vertically stacked ferroelectric capacitor (FIG. 1B). The passages that the Applicant cites refers to cases where the crystallographic texture is either random, <111> or a mixture. Even in such cases, Fox states that "the **bulk** of the film can be switched ferroelectrically" (col. 2: Ins. 30-31), which implies that at least 50% or more of the domains are functionally oriented. Furthermore, Fox states that in "each case, the direction of the polarization magnitude is **generally** from the bottom electrode 12 toward the top electrode 14," (col. 4: Ins. 9-1) which means that the domains are generally functionally oriented with respect to capacitor stack. Furthermore, Applicant

Art Unit: 2814

has not provided evidence of criticality or unexpected results for the range of "at least 40%." As stated above, where patentability is said to base upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Applicants argument with respect to claim 3 is not persuasive because Applicant has not provided evidence of criticality or unexpected results for the range of "at least about 60  $\mu\text{C}/\text{cm}^2$ ." The fact that "higher switched polarization allows the memory cells to be made smaller and more densely packed" does not demonstrate how **specifically** the range of at least about 60  $\mu\text{C}/\text{cm}^2$  is critical or produces unexpected results. In other words why is a switched polarization of 60  $\mu\text{C}/\text{cm}^2$  critical?

Applicants argument with respect to claim 21 is not persuasive because Uchiyama discloses in FIG. 5 a conductive contact **126** that extends through the dielectric layer **136** to a metal interconnect **139**.

### **Conclusion**

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any




extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Abul Kalam whose telephone number is 571-272-8346. The examiner can normally be reached on Monday - Friday, 9 AM - 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Abul Kalam

  
PHAT X. CAO  
PRIMARY EXAMINER